1   1. An apparatus for providing a variable flow of liquid,

2   comprising:

3

4   a. an AC permanent magnet synchronous motor pump controller

5   comprising a programmable micro controller with means generating AC pulse

6   switching signals applied to said motor pump for varying the flow rate of [an AC

7   permanent magnet synchronous] said motor pump over an extended range of

8   flow rates in accordance with said AC pulse switching signals [applied to said

9   motor pump], further comprising means setting the frequency of said AC pulse

10   switching signals for obtaining a given speed of said motor pump, wherein said

11   speed is synchronous to said frequency for all realizable speeds of said motor

12   pump, and further comprising means setting the pulse width of said AC pulse

13   switching signals in relation to said frequency for a given motor speed in order to

14   maintain constant and continuous flow for any given realizable speed of said

15   motor pump; and

16

17   [b. a programmable micro-controller incorporated into said controller,

18   comprising means calculating in a related manner both the pulse width and

19   frequency of said AC pulse switching signals for synchronously controlling said

20   motor pump over an extended range of flow rates; and]

21

22   [c]b. an output switching circuit incorporated into said controller[,

23   comprising means] for generating [an] said AC pulse [waveform] switching

24   signals and for driving said motor pump [according to] in direct synchronization

25   with the frequency of said AC pulse switching signals.

26

27

28

1   3. The apparatus of Claim 1 [2], further comprising an AC permanent-

2   magnet synchronous motor pump with means defining a rotor and impeller

3   [assembly] integrally coupled to said motor pump, wherein said [assembly is

4   comprised of a] rotor and [an] said impeller are immersed in a common liquid

5   medium, wherein said rotor and said impeller are concentric and wherein said

6   [assembly] rotor and said impeller [has means defining a rigid coupling between

7   said rotor and said impeller] are rigidly and fixedly coupled to [for] prevent[ing]

8   relative rotation, [of said impeller with respect to said rotor] for insuring that said

9   motor pump will reliably start rotation when energized with said controller and for

10 preventing impeller chatter when said motor pump is driven with said controller

11 over a range of realizable rotation rates.

12

13   8. The apparatus of Claim 1, further comprising a line

14 receiver/transmitter for interfacing an external [data input/output] DMX control

15 signal to said micro-controller.

16

17   10. The apparatus of Claim 1, further comprising a software

18 program embedded in said micro-controller for controlling the behavior of said

19 motor pump with said software program comprising means deriving in a related

20 manner the pulse width and frequency of control signals to be applied to said

21 output switching circuit and further comprising means generating said control

22 signals in such a manner as to produce said AC pulse switching signals at the

23 output of said switching circuit as required to synchronously drive said motor

24 pump at the frequency of said AC pulse switching signals and with said AC pulse

25 switching signals having a pulse width as required to maintain synchronization of

26 said motor pump with said AC pulse switching signals over all realizable speeds.

27

28

1   12. The apparatus of Claim [2]3 further comprising a fountain directly

2   coupled to said AC permanent magnet synchronous motor pump for generating

3   variable water patterns comprising:

4

5   a. at least one fountain element comprised of a water inlet and one or

6   more water outlets for the flow of water.

1   1. (amended) An apparatus for providing a variable flow of liquid,

2   comprising:

3

4   a. an AC permanent magnet synchronous motor pump controller

5   comprising a programmable micro controller with means generating AC pulse

6   switching signals applied to said motor pump for varying the flow rate of said

7   motor pump over an extended range of flow rates in accordance with said AC

8   pulse switching signals, further comprising means setting the frequency of said

9   AC pulse switching signals for obtaining a given speed of said motor pump,

10   wherein said speed is synchronous to said frequency for all realizable speeds of

11   said motor pump, and further comprising means setting the pulse width of said

12   AC pulse switching signals in relation to said frequency for a given motor speed

13   in order to maintain constant and continuous flow for any given realizable speed

14   of said motor pump; and

15

16   b. an output switching circuit incorporated into said controller for

17   generating said AC pulse switching signals and for driving said motor pump in

18   direct synchronization with the frequency of said AC pulse switching signals.

19

20   3. (amended) The apparatus of Claim 1, further comprising an AC

21   permanent-magnet synchronous motor pump with means defining a rotor and

22   impeller integrally coupled to said motor pump, wherein said rotor and said

23   impeller are immersed in a common liquid medium, wherein said rotor and said

24   impeller are concentric and wherein said rotor and said impeller are rigidly and

25   fixedly coupled to prevent relative rotation, for insuring that said motor pump will

26   reliably start rotation when energized with said controller and for preventing

27   impeller chatter when said motor pump is driven with said controller over a range

28   of realizable rotation rates.

1   8. (amended) The apparatus of Claim 1, further comprising a line

2 receiver/transmitter for interfacing an external DMX control signal to said micro-

3 controller.

4

5   10. (amended) The apparatus of Claim 1, further comprising a software

6 program embedded in said micro-controller for controlling the behavior of said

7 motor pump with said software program comprising means deriving in a related

8 manner the pulse width and frequency of control signals to be applied to said

9 output switching circuit and further comprising means generating said control

10 signals in such a manner as to produce said AC pulse switching signals at the

11 output of said switching circuit as required to synchronously drive said motor

12 pump at the frequency of said AC pulse switching signals and with said AC pulse

13 switching signals having a pulse width as required to maintain synchronization of

14 said motor pump with said AC pulse switching signals over all realizable speeds.

15

16   12. (amended) The apparatus of Claim 3 further comprising a fountain

17 directly coupled to said AC permanent magnet synchronous motor pump for

18 generating variable water patterns comprising:

19

20   a. at least one fountain element comprised of a water inlet and one or

21 more water outlets for the flow of water.

22

23

24

25